

**Characterization and Lifecycle Testing of Hydride Compressor Elements for the  
Planck Sorption Cryocooler\***

D. PEARSON, R.C. BOWMAN, M. SCHMELZEL, M. PRINA, P. BHANDARI, C.G.  
PAINE, and L.A. WADE  
Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, CA 91109

The Jet Propulsion Laboratory is developing two continuous 20 K nominal sorption-based coolers for the ESA led Planck mission. Sorbent beds containing the hydrogen absorbing alloy Lanthanum-Nickel<sub>4.8</sub>-Tin<sub>0.2</sub> are being tested to evaluate their performance as compressor elements for unprecedented two years of flight operation. In order to provide basic characterization and life cycling data, we have developed a test facility that allows us to test three prototype compressor elements under all conditions expected for the cooler operation. Each bed is continuously cycled over the temperature range between 280K and about 470K to follow the alternating absorption and desorption behavior of the hydride. We present data on the hydrogen mass flow rates and thermal characteristics for all phases of the compressor cycle, with an emphasis on the controlled absorption of hydrogen. This function of the compressor element is crucial since it establishes the cold end temperature of the cooler. We also present data obtained over thousands of temperature cycles from these beds to determine the extent of degradation of the compressor element performance from changes in the hydride sorbent or other sources. Finally, we discuss our future testing of a complete prototype cooler where 6 compressor elements will be used with a Joule-Thomson cold end to provide continuous cooling at 18 -20 K.

\*This research was carried out <sup>at</sup> by the Jet Propulsion Laboratory, California Institute of Technology under a contract with the National Aeronautics and Space Administration.